NARI/EU-ARD Climate Change Project

EU ARD Project – Site report

Derin Site – Madang Province/Papua New Guinea

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End of Project Report for the Derin (wet lowlands) Site.

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1. Project Site Description

Figure 1: Map of Papua New Guinea highlighting Derin study site.

Derin is located in the Transgogol area of Madang district on a depositional flood plain and in a dense forest area at 145.61℉ and 5.35℃ at an elevation of 52.43 meters above sea level. The site represents a low land excess moisture area in PNG. The Derin area covers 3 council wards of wards 7, 8 and 9 of Transgogol LLG. It has a population of 1, 002 with 600 male and 502 females with low to moderate access to services.

Madang is a high rainfall lowland area, having average monthly rainfall ranging between 110 mm – 410.7mm with an annual rainfall between 3000 and 4000 mm/y. Out of these, the month of March has the highest rainfall of 360 mm while the month of September found to have the lowest average rainfall of 13.6mm. The rainfall data derived from National Weather Service of PNG for the last nineteen years (1996-2014). Due to the climatic conditions Derin is classified as area with low drought vulnerability. The average annual monthly maximum temperature of the area ranges from 30.4℃ - 31.4℃ and minimum temperature from 23.8℃- 24.2℃. There is no greater variation in the minimum and maximum temperature all year around. Lowest and highest temperature rise or fall at 1℃ below the minimum or above maximum temperature (Figure 2).

The Derin landform is classified as composite alluvial plain formed through fluvial action. The landform on either side of the area is hilly terrain with weak or no structural control. The parent material of the soil in terms of its geological formation is sedimentary rocks under unconsolidated alluvial deposits. Having all detrital materials of recent age deposited by flowing water and/or gravity. They encompass fluviate, colluvial (scree), lacustrine and alluvial fan deposits composed of sand, gravel, silt, mud, clay, or angular rock fragment. The topographic position of the area is categorized as valley bottom flat (local low area in the landscape, undulating) to lower slope (PNGRIS, 2008).

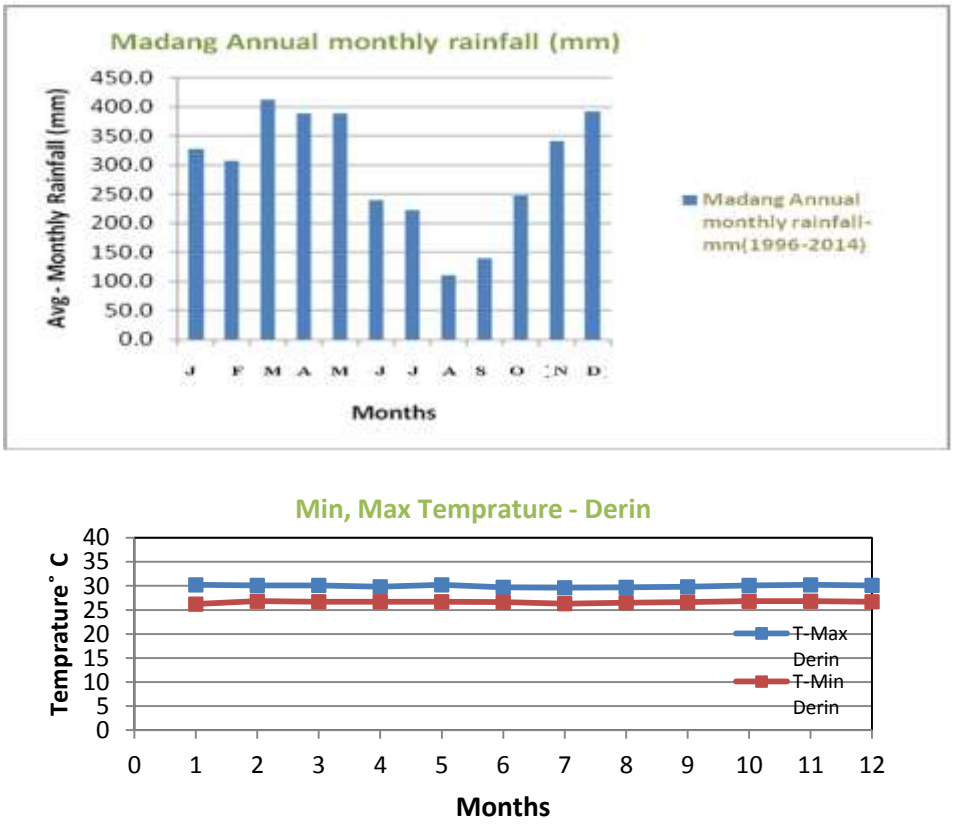

Figure 2: Mean monthly rainfall and minimum and maximum temperature at Madang (Source: NWS of PNG, 1996-2014)

The main great soil groups for the site along this composite alluvial plain are Fulvaquents, Haplaquolls and Hapludolls. The Fulvaquents are of order of Entisols with sub order Aquents, which are alluvial, young alluvial and recently alluvial soil. Haplaquolls is under the order Mollisols and suborder Aquolls, having poorly drained old alluvial soils and gleyed pelosols. Whereas the Hapludolls which are under order Mollisols and suborder Udolls, are young alluvial soils, imperfectly to well drain old alluvial and black clay soils (PNGRIS, 2008). The soil developed on recent or older alluvial or colluvial deposits and shows little or no profile development (Bleeker1983).

In the early 1970s JANT, a Japanese Logging company practiced clear fell logging by cutting down 73,000 ha of rain forest in the Transgogol Valley after purchasing the logging right (CFA, 2011). As a result water table rose that changed some of the agricultural potential land to disadvantage land (back swamps) in the low lying areas of the valley. Slash and burn farming system is mostly practiced, where the secondary forest and grass land are normally cut down and burned for gardening. Taro, yam, cassava, banana, and sweet potato are major stable food crops normally mix cropped with vegetables, corn, bean, and sugarcane etc. The tuber crops are normally harvested before the rainy season starts, due to rotting of tubers under excessive soil moisture. Many of the farmers prepare and store sago as an alternate staple food during wet season. Cocoa, coconut and betel nuts are cash crops for the villagers. They transport them to Madang market and cocoa buying points for income or sometimes betel nut buyers directly go to the village and purchase them in bags. A lot of people use to get involved in growing and milling rice but milling became a problem to and farmers stopped to grow rice. Domestic pigs and village chickens as well as broiler chickens and few ducks are kept by some villagers. Consideration for safe drinking water needs to be taken as ducks and free roaming pigs pose a threat to water sources. Water for drinking and

washing is sourced from the same river and some unprotected springs and wells. Derin community area is and used to be a logging area and swamps drained which heavily impacted community's water sources in quantity and quality.

Taro, yam and SP don't grow well during rainy season due to water logging. Only 3-4 farmers grow African yam. During rainy season cash from cocoa and beetle nut is used to buy store goods to complement banana and sago as major food source. During prolonged dry seasons, all water sources dry up and people obtain water by digging holes in the sand on the dried river beds or collecting water from water sources further away from their area.

2. Site Selection & Prioritization.

Collected information from FGD and baseline survey was summarized and analysed using SWOT methodology (Table 1). The following are other pertinent observations made during the initial needs assessment.

- In general Derin community had influx of 'easy' money from logging project in the past, which made them dependant on this income source and more vulnerable towards climate change, due to lack of alternative strategies for food production under changing climatic conditions. Community has not recognized opportunities arising from their good access to provincial markets or is not interested to invest much labor into potential enterprises. Ready access to markets may be capitalized on for sale of high demand livestock products, particularly meat and eggs from poultry. The community used the same water source which is also used by animals and livestock.
- One main water source which is usually accessed by both livestock and humans which was considered to be unsafe for human consumption and of its poor quality.
- Children often times are affected by water borne disease which parents (mothers) had to spend more time looking for cure in the Hospital and clinics

Table 1. Derin SWOT analysis

Strengths:	**Weaknesses:**
• A variety of different staple crops are grown • Options are available to bridge periods where major staple is not available (Yam grown for storage; SP and banana non-seasonal; also sago and breadfruit available during food shortages) • Cash crops are grown (cocoa/coconut, betelnut, mustard) • Variable cultivation practices for SP, both mounds and flatbeds • Traditional system to save own seed • Variety of sources of livestock/protein with focus on chicken and ducks • Strong cultural beliefs • Project has been done using Acacia for soil improvement and cash income (pulp)	• Not a lot of varieties per staple crop • Food storage (yams) but also used for social obligations • Use of own planting material only and from within the community • Using shifting cultivation, slash and burn • Decline in soil fertility and no use of practices to maintain yield • Pest and Diseases (esp. SP weevil, taro beetle other insects, TLB) and no action taken • Excess water and waterlogging, flooding and food shortage during that period • No reliable water source • Community does not appear to be keen to invest in technological solutions • Livestock only fed on HH scraps, own foraging • Relatively strong cultural beliefs

Opportunities:	Threats:
• Relatively close to provincial centre and markets • Introduction of non-traditional yams • Introduction technologies and practices to improve livestock production • Introduction of new crop varieties • Soil and Water management practices • Low tech sand filter for simple and basic drinking water purification • Improved knowledge on soil and soil fertility improving practices (Acacia system further dissemination) • Suitable for taro and vegetables • Link up with WASH or similar programs	• More irregular weather patterns • Population growth and shortage of land for farming • Logging destroyed natural forest • Increase in diseases • Bogia Coconut Syndrome, cocoa pod borer • Not interested labor intensive technologies

Based on SWOT analysis potential site activities per project component were identified and selected for the reporting back workshop and community prioritization and voting session. Community members were engaged in a reporting back workshop. Each community member was invited to participate in the prioritization of the major constraint in their area and wished to do something about it (Table 2). Only the top three to five priorities were considered for addressing by the project. These constraints were later converted to project outcomes and prioritized based on their needs and understanding of the concept. Both gender had a fair representation in the workshop

Table 2. Results of a voting exercise options addressing agricultural production constraints and opportunities at the workshop in Derin

Options voted on in Derin	Voters		
	women	**men**	**both**
1. improving soil fertility to increase the yield of my crops	2	14	16
2. improving management and feeding of pigs for food and income	10	19	29
3. improving drainage to mitigate negative impact of water logging on food crops	2	0	2
4. Improving the production of taro and/or sweet potato	8	10	18
5. integrating management of chickens, ducks and fish for food and income	0	8	8
6. protect tubers from influence of heavy rain and hot sun	0	0	0
7. introduction of other/new crops or crop varieties in my farming system	4	4	8
8. Diversifying livestock holdings to increase food (meat, eggs, milk) production	0	14	14
9. improve soil fertility for better production of my staple foods	0	1	1
10. Using some of my staple crops for livestock feed or other processing	3	1	4
11. Protecting our water source to improve our livelihood	13	31	44
Total Votes	**42**	**102**	**144**
Total Voters	**14**	**34**	**48**

Some observations made during voting session:

- The community showed keen interest in the issues and discussions and were very attentive.
- The councilor appeared to have a negative attitude towards women (e.g. women voted on pig management and feed and he commented they do not cart feed for pig; someone mentioned 3 women were standing for election and he said they were wasting their time, etc)

- One blind old woman was attentive and managed to make her vote with assistance of a young woman. She told the young woman were to place her stickers.
- One man objected to separate voting by women because he was concerned his wife may vote on different issues to him – which is exactly the purpose of the chosen approach.
- The issues were randomized when listed for voting unlike other sites where issues were listed by components.
- Although the gender groups did separate voting in separate buildings, with no influence from either group on the other, both groups voted the same top 3 priorities.
- Women were diplomatic in their voting. They were confident and did not try to influence others.
- Community appeared to be well tuned in and aware of what is happening around them, e.g. climate change and other things.

3. Interventions implemented at the site and summary of achievements

Table 3 shows an overview of outputs achieved and participation of different community members in relevant learning workshops and demonstrations that were conducted in Kopafo communities. There were usually a number of learning events conducted per output and some community members chose to participate in only one of the events while others participated in all events for that output.

Table 3. The various outputs and participation of community members in relevant technology demonstration and learning events at Derin Pilot site

Output	Description of output/ intervention	Farmers trained	Model farmers	Trials implemented
O1	Capacity for improved management and use of available water sources for domestic use increased in Derin Community	68	6	6
O2	Increased capacity of interested farmers in Derin community for using improved pig feeding and management practices	54	10	10
O2b	Increased capacity of interested farmers in Derin community for using duck fish integration systems	2	2	2
O3	Farmer-preferred excess moisture tolerant sweet potato varieties identified and available to the Derin community	18		
O4	Farmer preferred Taro varieties identified and available to the Derin community	34	5	5

Despite his initial negative attitudes during the needs assessment and reporting back workshop, the Derin councilor was one of the main drivers for the successful implementation of the project activities. He was keen to take over the role of a local organizer and used his position and the project to politically benefit and improve his standing within the community. To some extended this had a positive impact on implementation, because he understood to bring the message across to other farmers. Especially the distribution of materials for specific activities was well and centralized organized through the councilor. He monitored the agreed contributions through the community, which were set as priorities prior to the project team planned interventions. On one hand this bears the risk of one person making decisions whom to involve in project activities, but clearly makes it easier to convey messages to a wider community and organize activities and monitor implementation thereof while the project team is not onsite. However he was not actively trying to involve more women, who would especially have been very important for all water related activities. The project team had to take extra effort to get important messages with respect to water and hygiene across to female members of the community. Table 4 shows a summary of technologies or innovations introduced and farmer impressions during implementation.

Table 4. Technologies/ innovations disseminated as part of project interventions at Hisiu/Yule Island pilot site and farmer impressions

Output	Description of intervention	Tech./farming practice	Farmers response and impressions
O1	Capacity for improved management and use of available water sources for domestic use increased in Derin Community	CLTS (Community led total sanitation) assessment	• Villagers upstream heavily contaminate the water source • Majority of people don't build latrine, and don't have the attitude of going to the pit latrine toilets. • Some toilet huts looked disused and very old, & track to the toilet was bushy as an indication of toilet not being used • People just walk into the nearby bushes and defecate. • The increased number of free roaming livestock (chicken and pigs) seen in the villages feed on them.
		Hygiene awareness and planning workshop (PHAST)	• Hygiene aspects of water and sanitation were well received by community and health implications understood • Community was happy to see that their main concern and priority was addressed • Community collaborated well and agreed to the terms set prior the construction of the RWH systems
		Construction of rain water harvesting and shallow hand dug well including water management training	• Involved households and communities were very pleased with this activity and contributed to their given tasks
		Training on water purification and construction and use of BSF and SODIS	• Activity was seen as a major benefit to the communities and a lot of effort was taken to get necessary skills to build and maintain the systems
		Training on water purification and construction and use of BSF and SODIS - Follow-up and in depth training at Aiyura for selected farmers of Murukanam and Derin	
O2	Increased capacity of interested farmers in Derin community for using improved pig feeding and management practices	Improved pig management and feeding 1. Supplementary feeding 2. Silage 3. Pig shed and fencing	• The idea of keeping pigs inside pens was well taken up by the community • Pigs posed a greater problem of destroying gardens which lead to creating local disputes among the villages. • Farmers who have pigs inside pens generally observed weight gains. • Waste is managed better. • Due to a directives given to killing all stray pigs has resulting in many pigs going missing, forcing farmers to quickly build sheds for their pigs. • Organized distribution of materials through the councilor put genuinely interested farmer in a good position

O2b	Increased capacity of interested farmers in Derin community for using duck fish integration system	Pond and duck house construction and management	• Only farmers with a reliable water source are able to establish a system.
O3	Farmer-preferred excess moisture tolerant sweet potato varieties identified and available to the Derin community	1. Early maturing high yielding 2. High soil moisture tolerant sweet potato varieties 3. Improved planting practice (1 tip @ 180°)	No comments available
O4	Farmer preferred Taro varieties identified and available to the Derin community	New Taro varieties tested	• Farmers were not happy that all taro in their gardens were harvested at once, those varieties actively growing should not to be harvested • Farmers produce only for consumption and economic activity is low. Selling taro is not considered priority for the community

4. Challenges during Project Implementation

Key to successful implementation onsite is a reliable contact person, who has a good standing within a community and is a well respected person. Another important aspect is to work with motivated model farmers and carefully select innovative lead farmers. While this is often not a decision a project team can and should make, a close collaboration with the community is necessary to identify suitable persons during the project initiation and implementation phase. This however might lead to issues within the community, when too much attention is given to single farmers.

Though the technologies implemented as part of interventions have being proven to be successful on-station, these were at times difficult to prove on-farm due to different perceptions of farmers or miss communication. Clear communication of the main objectives has proven to be of major importance for a successful intervention. In some cases the failure of the project team to clearly explain the purpose and goals of the project has lead to misunderstanding and miss interpretation of the planned activities. Therefore constant and unambiguous communication with the community is of highest essence for the success of project activities.

Table 5. Issues of significance that impacted the project implementation schedules

Challenge	Effect on interventions	Approach taken
Road blockages and deteriorating road conditions	Delay in implementation of planned activities	• Defer planned activities to a suitable date
Establish trust between project team and community	Delay of planned activities and extended implementation period	• Adequate number of meetings and FGD
Communication between project team and community	Understanding the technical aspects of the interventions and cultural implications	• Using simplified TokPisin and pictures in explanations/Trainings, etc… • Using model farmers with some educational background and experiences to explain difficult concepts in local language • Have a suitable contact person and innovative lead farmers • Take sufficient time to explain objectives of the project

No contact to local and regional district administrators	Lack of sustainability of interventions and long-term impact and dissemination of knowledge	• Closer collaboration with community and especially lead farmers

Constant evaluation of dissemination approaches; feedbacks from technology dissemination procedures and studies on technology adoption are invaluable for refining dissemination approaches and success in technology transfer and are areas that can be explored by social researchers. Collaborative efforts between research and extension bodies are vital for widespread and effective dissemination of agricultural technologies and strengthening research and extension linkages which is currently a constraint in the project and project sites.

5. Final Assessments and Comments

Final site assessments in Derin took place in November 2015. The following is a summary show a summary of responses on technology performance and responses of representative farmers during focus group discussions. Further information can be found in Tables 6 and 7.

Assessments and comments as per output category:

O1 Capacity for improved management and use of available water sources for domestic use increased in Derin Community Water Tanks

Five rain water harvesting systems (RWH) were distributed and assembled in specific strategic locations identified by the local members of the community of Derin. These tanks cater for rain water collection and storage for use during dry season. The tanks however were empty after the prolonged El Nino induced drought. In each of the 5 locations where the tanks are located, water committees were formed to maintain the tanks and also monitor water rations for the community members. Additional water management training was conducted to raise awareness for these issues. It however depends on the community members and their leaders to continue maintaining the function of the water committees.
The shallow hand dug well was one of the options for accessing water. However, the construction of the well was very laborious therefore only one well was installed.
The introduction of the biosand filter technology was well received by the community members. This technology significantly benefits the community members by providing safe drinking water which simultaneously also reduce health risk associated with poor quality of water and waterborne diseases. Female members mentioned the reduced need to make use of health services.

O2 Increased capacity of interested farmers in Derin community for using improved pig feeding and management practices

Farmers were trained how to keep pigs in fenced pig house with roof and were also introduced to new feeding techniques (silage) which greatly improved the pigs' performance in terms faster growth rate and weight gains. The model farmers responded positively and mentioned that with the introduction of the pig husbandry and management practices the pigs perform much better than the tradition or cultural practice of free ranching. In addition the technologies also solved other related problems of destroyed food gardens and polluted water sources through free roaming pigs.

O3 Farmer-preferred excess moisture tolerant sweet potato varieties identified and available to the Derin community

Farmers mentioned that the number and size of tubers of the introduced SP varieties are better compared to the traditional or local varieties/practices. The introduced varieties are larger in sizes but have fewer tubers compared to the local varieties which have more tubers which are smaller in sizes. Form these observations, farmers prefer to keep and cultivate both varieties utilizing traditional and improved cropping practices.

O4 Farmer preferred Taro varieties identified and available to the Derin community

Due to the El Nino induced drought, most of the planted taro died except 2 to 3 varieties. Those varieties that survived performed well and also better compared to the traditional ones. Farmers also mentioned their better taste and bigger comb sizes. The traditional plots/gardens are bigger in sizes (2500-5000 m2) compared to the plot size used for the demonstrations. There is a growing interest among farmers for certain NARI taro varieties which performed extremely well during the drought.

General observation:

In general, the interest in all the interventions introduced through the project remains to be very high in the community. Community members mentioned that the priorities selected during the needs assessment were relevant and appropriate and met the needs of the community.

1) Cash benefits from the introduced interventions

Given the demand for pig, there is already a market available, and some model farmers are already engaged in selling pigs at market price for about K800–K1000 depending on the sizes and demand.

2) General interest in the community

The community members and other surrounding communities showed a lot of interest in both introduced types of crops especially taro. The increased yield and quality of the crop convinced farmers to adopt the improved practice and introduced new technologies.

3) Likelihood of further adoption of different introduced technologies

Positive responses from farmers regarding the tangible (changes in crops yield, changes in pig performance etc…) and intangible benefits (general improvement in the health and welfare of community members) are an indicator that introduced technologies will be accepted and adopted by the community. Farmers are requesting for more seeds which shows that after the drought, more adoption and extension is expected within and around neighboring communities as well.

Table 6: Technology performance in Hisiu Community as assessed by representative community members

Technology	**Performance -Better -Same -Poor**	**Area Cultivated (for crops)**			**Do they plan to continue in the future (livestock)? -Yes -No**	**General Interest from the community- High (H) Medium (M) Low (L) Give Reason**	**Engage in Market. If Yes, What is the price?**
		Old practice	New Practice	Plan to Expand, If yes by how many			
Improved management and feeding of pigs for food and income	Better				Yes	High-Pigs perform better than local practice	K800-K1000/pig
Improved production practices and farmer preferred taro varieties (34 Var)	• Taro-2-3 varieties (Better)- • Others either same or poor	2500-5000 + m^2).	Less than 1000 m^2 Planted only for experimental plots. Most suckers damaged	Size depends on seed availability		High- Certain varieties were able to withstand the drought Better Taste size, color and taste	Own consumption
Improved production practices and farmer preferred sweet potato varieties (8 varieties)	SP- Same	400-420 m^2	400-420 m^2 (1 vine planted in an horizontal orientation	No clear confident response		Medium- No preference for the new introduced practice	Own consumption
Improved management and use of available water source for domestic use	The water harvesting Systems, shallow well and the biosand filter all were appropriate, relevant and useful to the community members as they address their water needs.						

Table 7: Responses from Focus Group at Kopafo during final assessment on food production and priorities

Periods of Food Shortage	September to January, caused by shifting from old to new gardens.
Views on whether improved technologies would improved food shortage period	Pig production is seen as the way forward and also taro production has the potential to improve food security and availability during the food scarce period. However, the water component has been the highland has it important for health and welfare of children and mothers.
5 Years ago, communities voted on certain priorities. Do these still remain important or have now changed?	The interventions voted were of high importance therefore farmers were glad having made those choices. "The interventions chosen were important and applicable to our situation and needs". Water, an important need in the community was solve to some degree through the biosand filter, shallow water well and tanks which were set up. Furthermore, given the 2015 drought El Nino induced draught, they have access clean and safe drinking water and it impacted their welfare/livelihood positively. It was said that the decision made five years ago (2012) was relevant and appropriate to the needs identified within the communities. 'The choices made were the best and they help solve our basic needs which water is one of them.'